CAT® Lift Trucks

Service Manual

MC/FC

Chassis, Mast & Options

EP16KT	**ETB4A-00011-up**
EP18KT	**ETB5A-00011-up**
EP20KT	**ETB5A-50001-up**

For use with EP16KT-EP20KT Controller Service Manual.

99719-66100

FOREWORD

This service manual is a guide to servicing of Cat® lift trucks. The instructions are grouped by systems to serve the convenience of your ready reference.

Long productive life of your lift truck depends to a great extent on correct servicing --- servicing consistent with what you will learn from this service manual. Read the respective sections of this manual carefully and familiarize yourself with all the components you will work on, before attempting to start a test, repair or rebuild job.

The descriptions, illustrations and specifications contained in this manual are of the trucks with the serial numbers in effect at the time it was approved for printing. Cat lift truck reserves the right to change specifications or design without notice and without incurring obligation.

Safety Related Signs

The following safety related signs are used in this service manual to emphasize important and critical instructions:

⚠ WARNING — Indicates a specific potential hazard that could result in serious bodily injury or death.

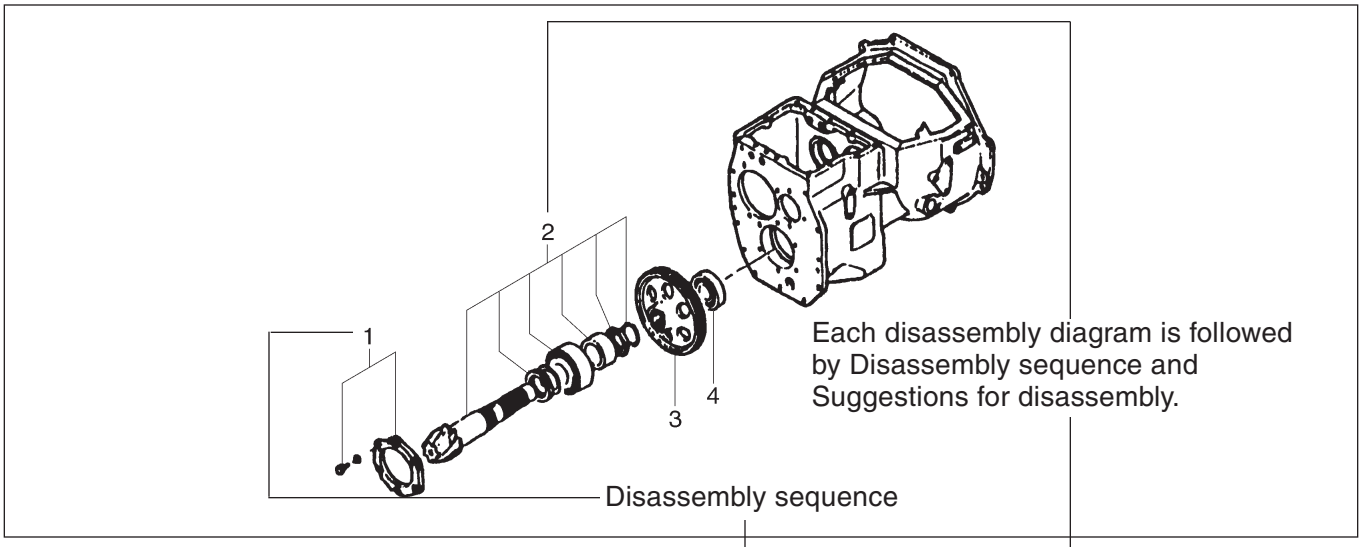
⚠ CAUTION — Indicates a specific potential hazard that may result in bodily injury, or damage to, or destruction of, the machine.

NOTE — Indicates a condition that can cause damage to, or shorten service life of, the machine.

Pub. No. 99719-66100

HOW TO READ THIS MANUAL

Disassembly diagram (example)

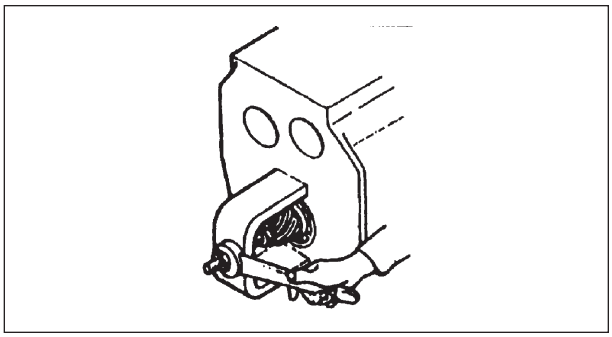


Sequence

1. Cover, Bolt, Washer (part name)
2. Output shaft (part name)

Suggestion for disassembly

(1) Output shaft removal



Unit: mm (in.)

Clearance between cylinder and piston	A	0.020 to 0.105 (0.00079 to 0.00413)
	B	0.15 (0.0059)

A: Standard value B: Repair or service limit

SAFETY

⚠WARNING

The proper and safe lubrication and maintenance for this lift truck, recommended by Cat lift truck, are outlined in the OPERATION & MAINTENANCE MANUAL for these trucks.

Improper performance of lubrication or maintenance procedures is dangerous and could result in injury or death. Read and understand the OPERATION & MAINTENANCE MANUAL before performing any lubrication or maintenance.

The serviceman or mechanic may be unfamiliar with many of the systems on this truck. This makes it important to use caution when performing service work. A knowledge of the system and/or components is important before the removal or disassembly of any component.

Because of the size of some of the truck components, the serviceman or mechanic should check the weights noted in this Manual. Use proper lifting procedures when removing any components.

Following is a list of basic precautions that should always be observed.

1. Read and understand all warning plates and decals on the truck before operating, lubricating or repairing the product.
2. Always wear protective glasses and protective shoes when working around trucks. In particular, wear protective glasses when pounding on any part of the truck or its attachments with a hammer or sledge. Use welders gloves, hood/goggles, apron and other protective clothing appropriate to the welding job being performed. Do not wear loose-fitting or torn clothing. Remove all rings from fingers when working on machinery.
3. Do not work on any truck that is supported only by lift jacks or a hoist. Always use blocks or jack stands to support the truck before performing any disassembly.

⚠WARNING

Do not operate this truck unless you have read and understand the instructions in the OPERATION & MAINTENANCE MANUAL. Improper truck operation is dangerous and could result in injury or death.

4. Lower the forks or other implements to the ground before performing any work on the truck. If this cannot be done, make sure the forks or other implements are blocked correctly to prevent them from dropping unexpectedly.
5. Use steps and grab handles (if applicable) when mounting or dismounting a truck. Clean any mud or debris from steps, walkways or work platforms before using. Always face truck when using steps, ladders and walkways. When it is not possible to use the designed access system, provide ladders, scaffolds, or work platforms to perform safe repair operations.
6. To avoid back injury, use a hoist when lifting components which weigh 23 kg (50 lb.) or more. Make sure all chains, hooks, slings, etc., are in good condition and are of the correct capacity. Be sure hooks are positioned correctly. Lifting eyes are not to be side loaded during a lifting operation.
7. To avoid burns, be alert for hot parts on trucks which have just been stopped and hot fluids in lines, tubes and compartments.
8. Be careful when removing cover plates. Gradually back off the last two bolts or nuts located at opposite ends of the cover or device and pry cover loose to relieve any spring or other pressure, before removing the last two bolts or nuts completely.
9. Be careful when removing filler caps, breathers and plugs on the truck. Hold a rag over the cap or plug to prevent being sprayed or splashed by liquids under pressure. The danger is even greater if the truck has just been stopped because fluids can be hot.

10. Always use tools that are in good condition and be sure you understand how to use them before performing any service work.
11. Reinstall all fasteners with same part number. Do not use a lesser quality fastener if replacements are necessary. Do not mix metric fasteners with standard nuts and bolts.
12. If possible, make all repairs with the truck parked on a level, hard surface. Block truck so it does not roll while working on or under truck.
13. Disconnect battery and discharge any capacitors (electric trucks) before starting to work on truck. Hang "Do not Operate" tag in the Operator's Compartment.
14. Repairs, which require welding, should be performed only with the benefit of the appropriate reference information and by personnel adequately trained and knowledgeable in welding procedures. Determine type of metal being welded and select correct welding procedure and electrodes, rods or wire to provide a weld metal strength equivalent at least to that of parent metal.
15. Do not damage wiring during removal operations. Reinstall the wiring so it is not damaged nor will it be damaged in operation by contacting sharp corners, or by rubbing against some object or hot surface. Do not connect wiring to a line containing fluid.
16. Be sure all protective devices including guards and shields are properly installed and functioning correctly before starting a repair. If a guard or shield must be removed to perform the repair work, use extra caution.
17. Always support the mast and carriage to keep carriage or attachments raised when maintenance or repair work is performed, which requires the mast in the raised position.
18. Loose or damaged fuel, lubricant and hydraulic lines, tubes and hoses can cause fires. Do not bend or strike high pressure lines or install ones which have been bent or damaged. Inspect lines, tubes and hoses carefully. Do not check for leaks with your hands. Pin hole (very small) leaks can result in a high velocity oil stream that will be invisible close to the hose. This oil can penetrate the skin and cause personal injury. Use cardboard or paper to locate pin hole leaks.
19. Tighten connections to the correct torque. Make sure that all heat shields, clamps and guards are installed correctly to avoid excessive heat, vibration or rubbing against other parts during operation. Shields that protect against oil spray onto hot exhaust components in event of a line, tube or seal failure, must be installed correctly.
20. Relieve all pressure in air, oil or water systems before any lines, fittings or related items are disconnected or removed. Always make sure all raised components are blocked correctly and be alert for possible pressure when disconnecting any device from a system that utilizes pressure.
21. Do not operate a truck if any rotating part is damaged or contacts any other part during operation. Any high speed rotating component that has been damaged or altered should be checked for balance before reusing.

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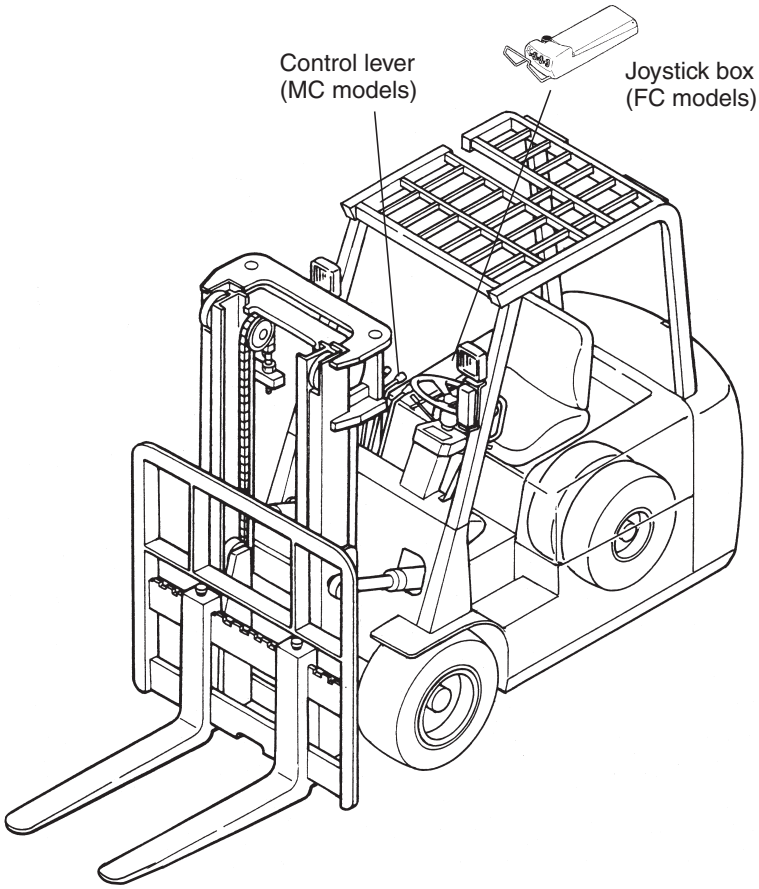
Vehicle Exterior



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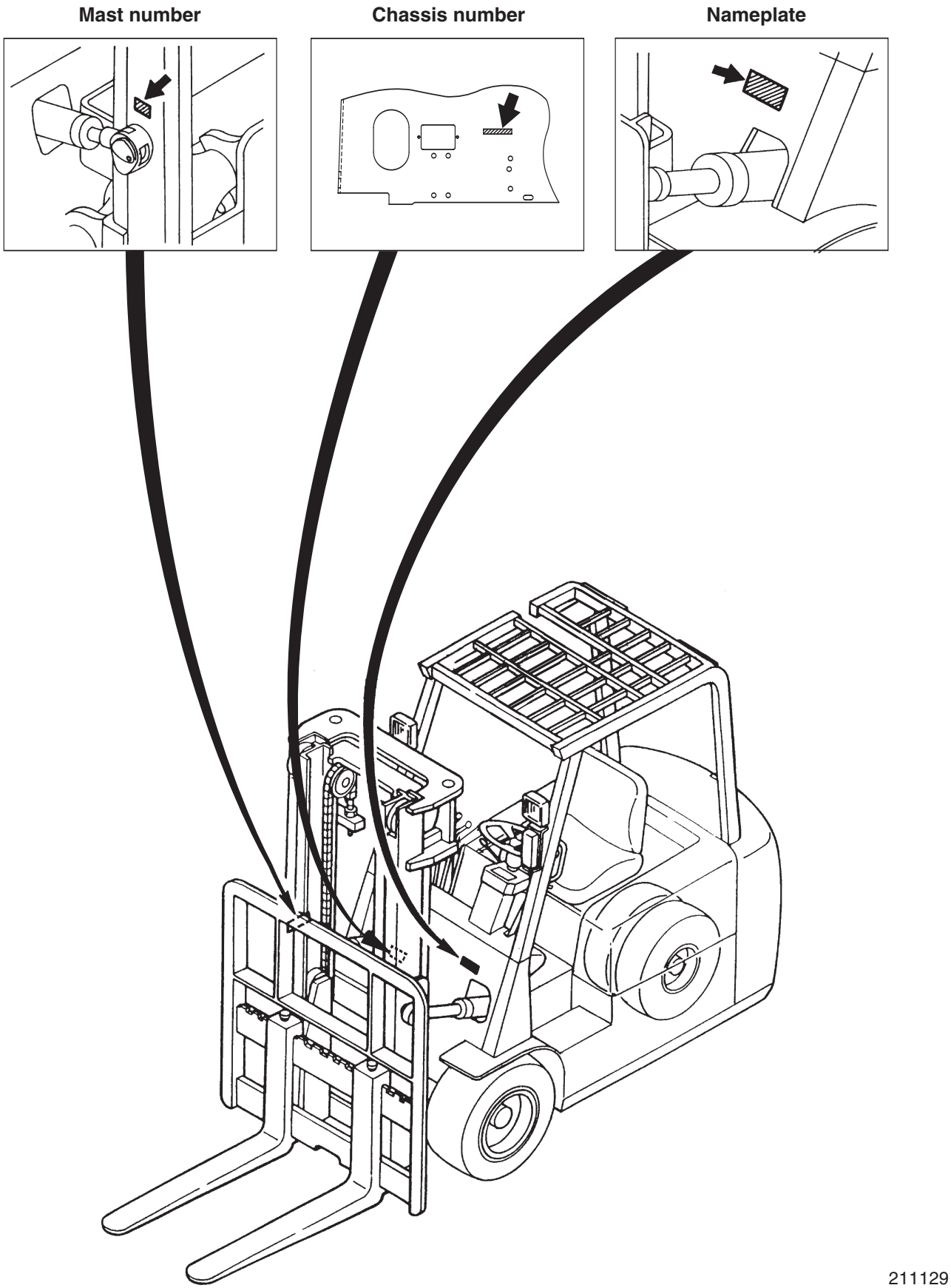
Models

This manual applies to EP16KT, EP18KT and EP20KT.

Truck Model	Serial Number
EP16KT	ETB4A-00011-up (48V)
EP18KT	ETB5A-00011-up (48V)
EP20KT	ETB5A-50001-up (48V)

Serial Number Locations



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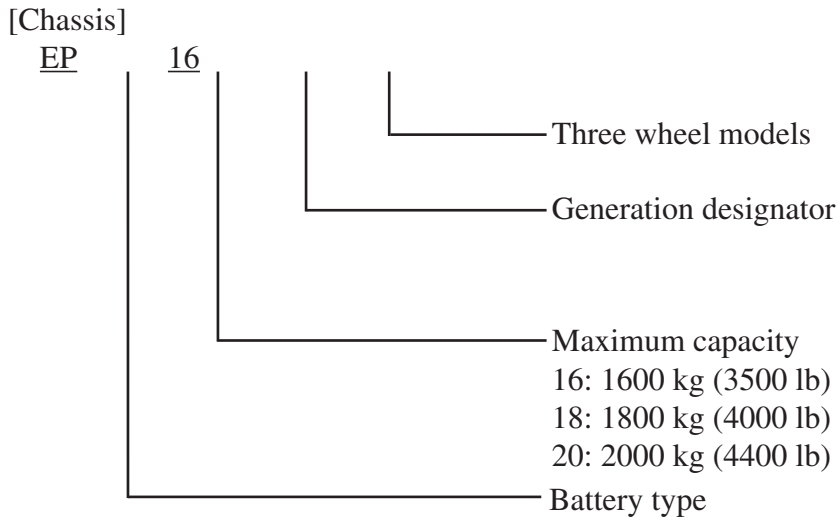
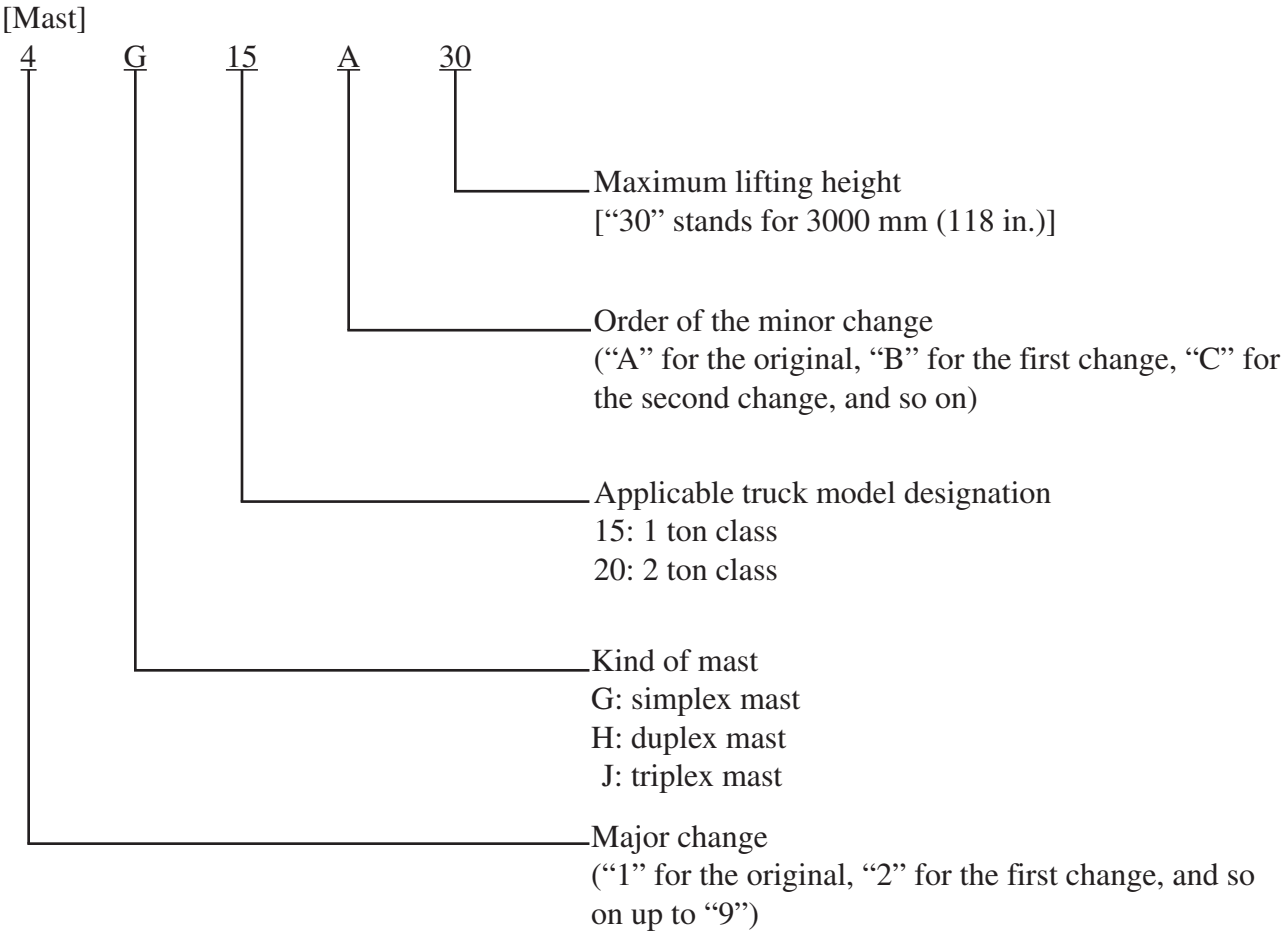
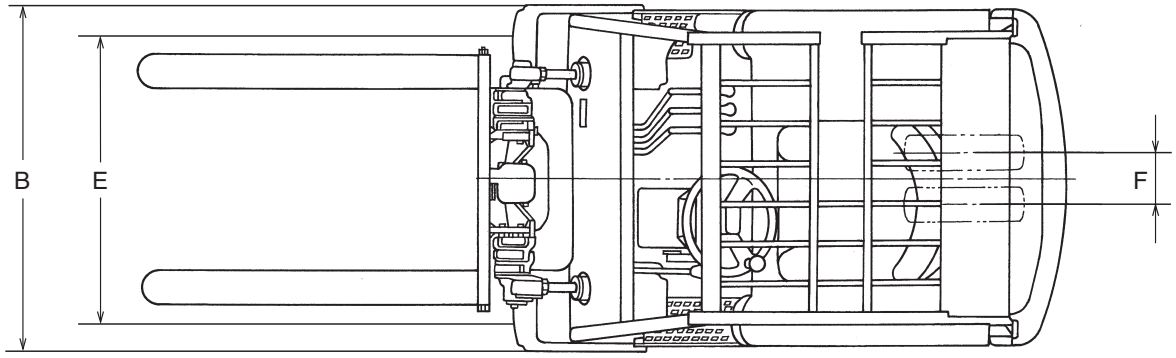
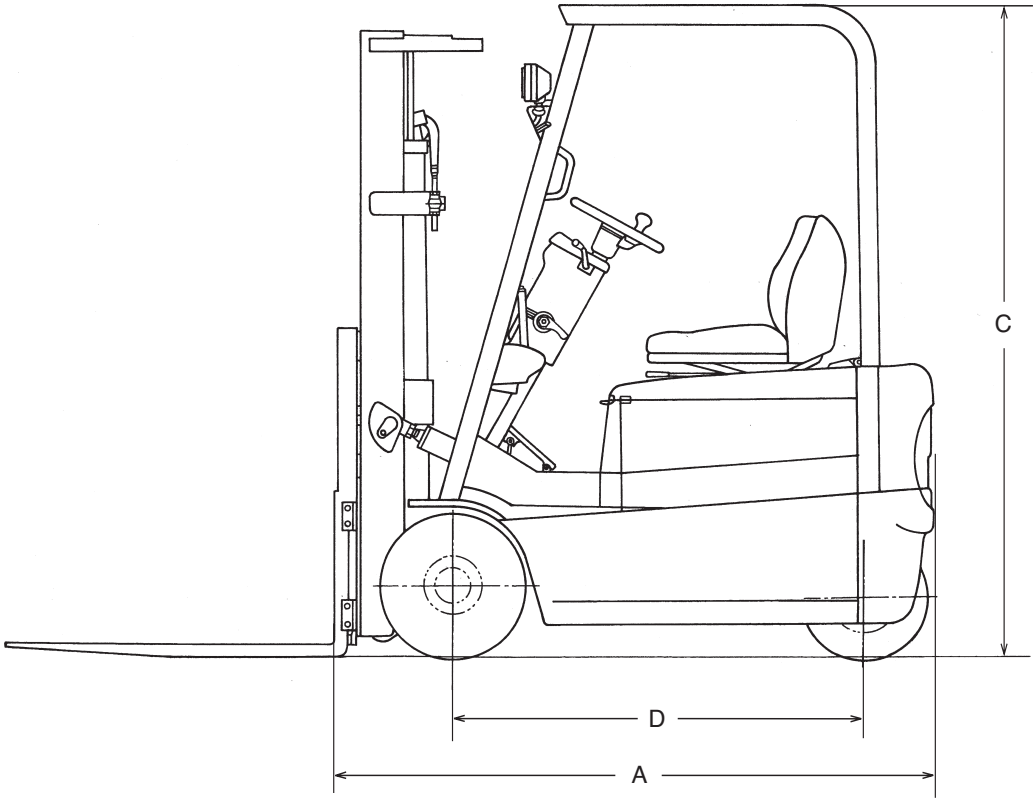
Chassis and Mast Model Identification




[Mast]
4
G
15
A
30
Maximum lifting height
["30" stands for 3000 mm (118 in.)]
Order of the minor change
("A" for the original, "B" for the first change, "C" for the second change, and so on)
Applicable truck model designation
15: 1 ton class
20: 2 ton class
Kind of mast
G: simplex mast
H: duplex mast
J: triplex mast
Major change
("1" for the original, "2" for the first change, and so on up to "9")

Dimensions





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Technical Data

Truck Models				EP16KT	EP18KT	EP20KT
Class				1.6 ton	1.8 ton	2.0 ton
Load Capacity/Load Center			N (kgf)/mm [lbf/in.]	15690 (1600)/500 [3500/20]	17650 (1800)/500 [4000/20]	19610 (2000)/500 [4400/20]
Truck size	Length to Fork Face	A	mm (in.)	1893 (74.5)	1996 (78.6)	2032 (80.0)
	Width	B	mm (in.)	1070 (42.1)	1070 (42.1)	1130 (44.5)
	Height of Overhead Guard	C	mm (in.)	2040 (80.3)	2040 (80.3)	2040 (80.3)
Wheelbase		D	mm (in.)	1307 (51.5)	1410 (55.5)	1410 (55.5)
Service Weight (W/O Battery)			kg (lb)	1700 (3748)	1765 (3891)	1975 (4354)
Tread Front/Rear		E/F	mm (in.)	913/170 (35.9/6.7)	913/170 (35.9/6.7)	935/170 (36.8/6.7)
Tires Number Front/Rear				2/2	2/2	2/2
Tires Size	Front			18 × 7-8	18 × 7-8	200/50-10
	Rear			15 × 4.5-8	15 × 4.5-8	15 × 4.5-8
Turning Radius			mm (in.)	1517 (59.7)	1620 (63.8)	1645 (64.8)
Travel Speeds Unloaded/Loaded			km/h (mph)	16/14 (9.9/8.7)	16/14 (9.9/8.7)	16/14 (9.9/8.7)
Gradeability Loaded			%	19	17	15
Lift Speeds Unloaded/Loaded			m (in.)/sec	0.60/0.40 (23.6/15.7)	0.60/0.39 (23.6/15.4)	0.60/0.38 (23.6/15.0)
Lowering Speed Unloaded/Loaded			m (in.)/sec	0.50/0.52 (19.7/20.5)	0.50/0.52 (19.7/20.5)	0.50/0.52 (19.7/20.5)
Battery Voltage			V	48	48	48
Battery Rated Capacity (5 hrs.) MAX			Ah	600	720	720
Battery Compartment Size Length × Width × Height			mm (in.)	521 × 1006 × 650 (20.5 × 39.6 × 25.6)	624 × 1006 × 650 (24.6 × 39.6 × 25.6)	624 × 1006 × 650 (24.6 × 39.6 × 25.6)
Tilt Angle (forwards-backwards)				6°-7°	6°-7°	6°-7°
Traction Motor, 60 min rating			kW	2 × 4.5	2 × 4.5	2 × 4.5
Hydraulic Motor			kW	11.5	11.5	11.5
Steering Motor, 60 min rating			kW	0.54	0.54	0.54
Traction Motor Control Method				IGBT CHOPPER	IGBT CHOPPER	IGBT CHOPPER
Hydraulic Motor Control Method				IGBT CHOPPER	IGBT CHOPPER	IGBT CHOPPER

VEHICLE ELECTRICAL COMPONENTS

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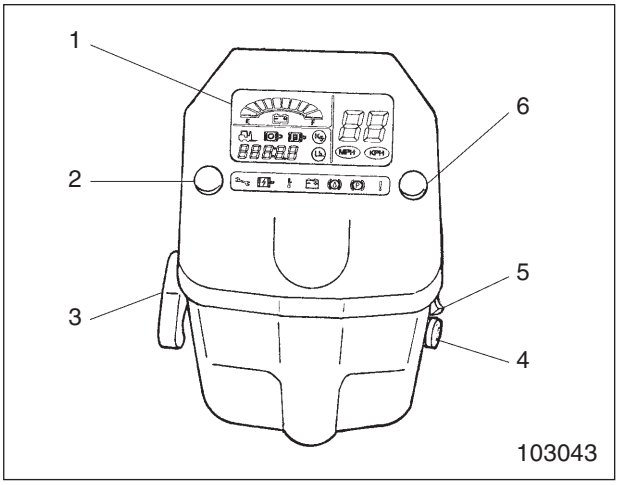
Console Box

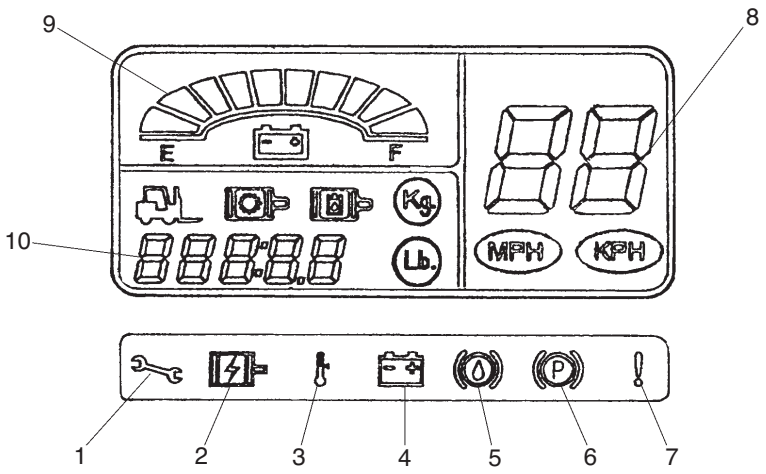
1 Central vehicle monitoring system (CVMS)
2 Mode selector button
3 Steering tilt lever
4 Key switch
5 Lighting switch
6 Mode check button



NOTE

For setting the clock and selection of KPH or MPH, refer to "Selection of KPH or MPH" and "Setting the clock".

Functions of Central Vehicle Monitor System (CVMS)



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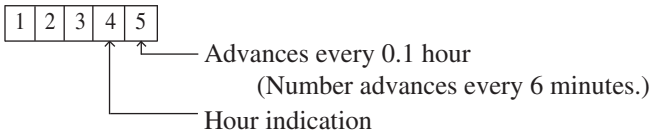
Operations

No.	Monitor name	When OFF	When ON or flashing	Remarks
1	Service indicator	Starts flashing 20 hours before set time. Remains ON when set time is reached.		
2	Motor brush wear indicator	Drive motor and pump motor brushes in operable condition	Brushes are worn.	After brushes are replaced, indicator turns OFF.

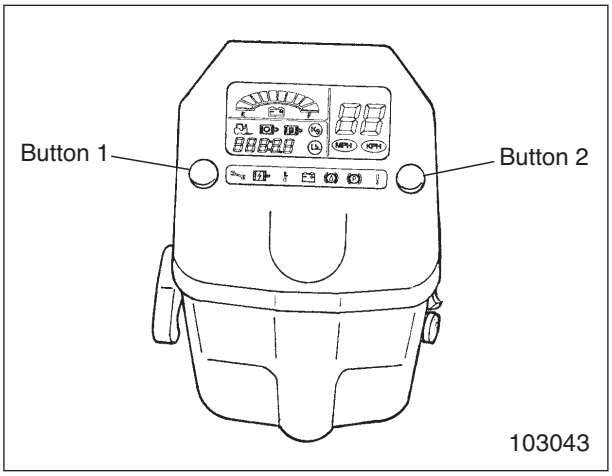
No.	Monitor name	When OFF	When ON or flashing	Remarks
3	Controller/motor overheat indicator	Controller, drive motors and pump motor in normal temperature	Overheating	Overheating causes a significant output loss. When component temperature returns to normal levels, output power returns.
4	Remaining battery charge warning light	Normal battery condition	Flashing indicates battery needs to be recharged soon. ON indicates battery needs to be recharged and lifting function inoperable.	
5	Brake fluid level indicator	Normal fluid level	Low fluid level	
6	Parking brake warning light	Parking brake disengaged	Parking brake disengaged	
7	Malfunction lamp	Normal	Vehicle malfunction	
8	Speedometer Error indicator	KPH, MPH		
9	Battery discharge indicator	When no bars show, vehicle is drivable but lifting function is inoperable.		Indicates remaining battery power.
10	Hour meter			

BUY NOW

Selection of KPH or MPH

1. Apply the parking brake.
2. Place the direction lever in NEUTRAL.
3. Turn the key switch to the I (ON) position.
4. Push and hold button 1 for one to two seconds.

NOTICE: Display will show KPH and a 24-hour clock until it is changed. When MPH is selected, the clock will change to a 12-hour clock.



Setting the clock

1. Apply the parking brake.
2. Place the direction lever in NEUTRAL.
3. Turn the key switch to the I (ON) position.
4. Push and hold button 1 until the minutes' display flashes.
5. Release button 1.
6. Adjust the minutes with button 2.
7. Push button 1 and release when the hours' display flashes.
8. Adjust the hour with button 2.
9. Push button 1 to lock in the time.

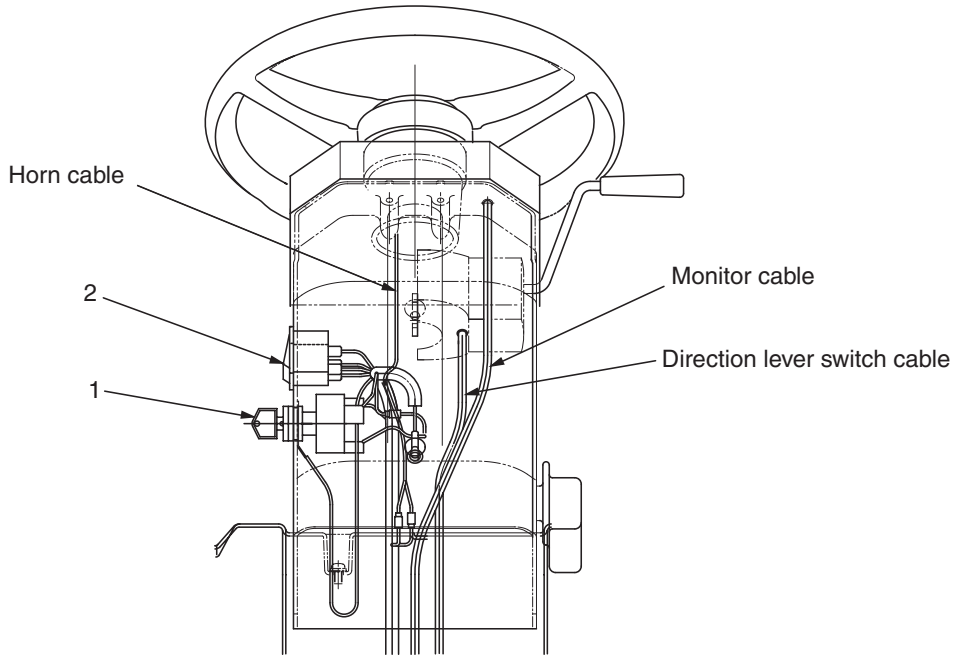
Error code display

Indication	Condition
E	When key switch is set to (ON) with direction lever in (F) or (R) position. Turns OFF when the lever is set to (N).
E 0 ON	Right drive motor overheat
E 1 ON	Left drive motor overheat
E 2 ON	Pump motor overheat
E 3 ON	Controller overheat
E 4 ON	Worn right drive motor brush
E 5 ON	Worn left drive motor brush
E 6 ON	Worn pump motor brush
H 1 ON	Faulty setting of lift lever
H 2 ON	Faulty setting of tilt lever

Error code display

Indication	Condition
H 3 ON	Faulty setting of attach-1 lever
H 4 ON	Faulty setting of attach-1 lever (Option)

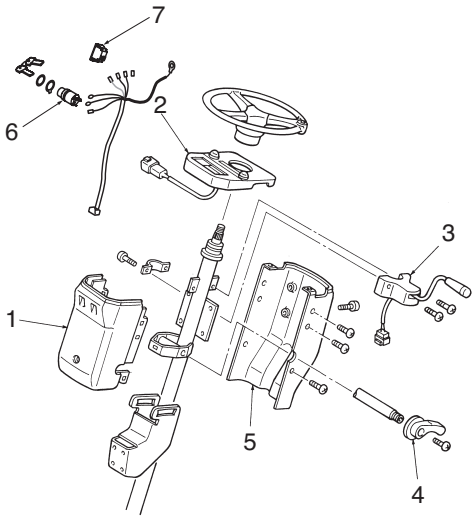
Electrical Components in Console Box



1 Key switch
2 Lighting switch

Disassembly and Reassembly

Disassembly



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Sequence

1 Console box (front panel)
2 Central vehicle monitor panel
3 Direction lever
4 Steering tilt lever
5 Console box (rear panel)
6 Key switch
7 Light switch

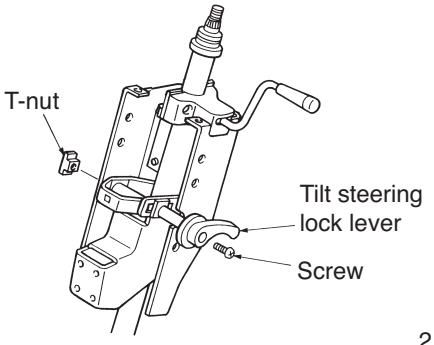
Disassembly procedure

(1) Remove the front panel and monitor panel from the console box.

(2) Disconnect the harness connectors from the horn and direction lever.

(3) Remove the screw from the steering tilt lever, and remove the lever from the rear panel of the console box.

(4) Remove the rear panel.



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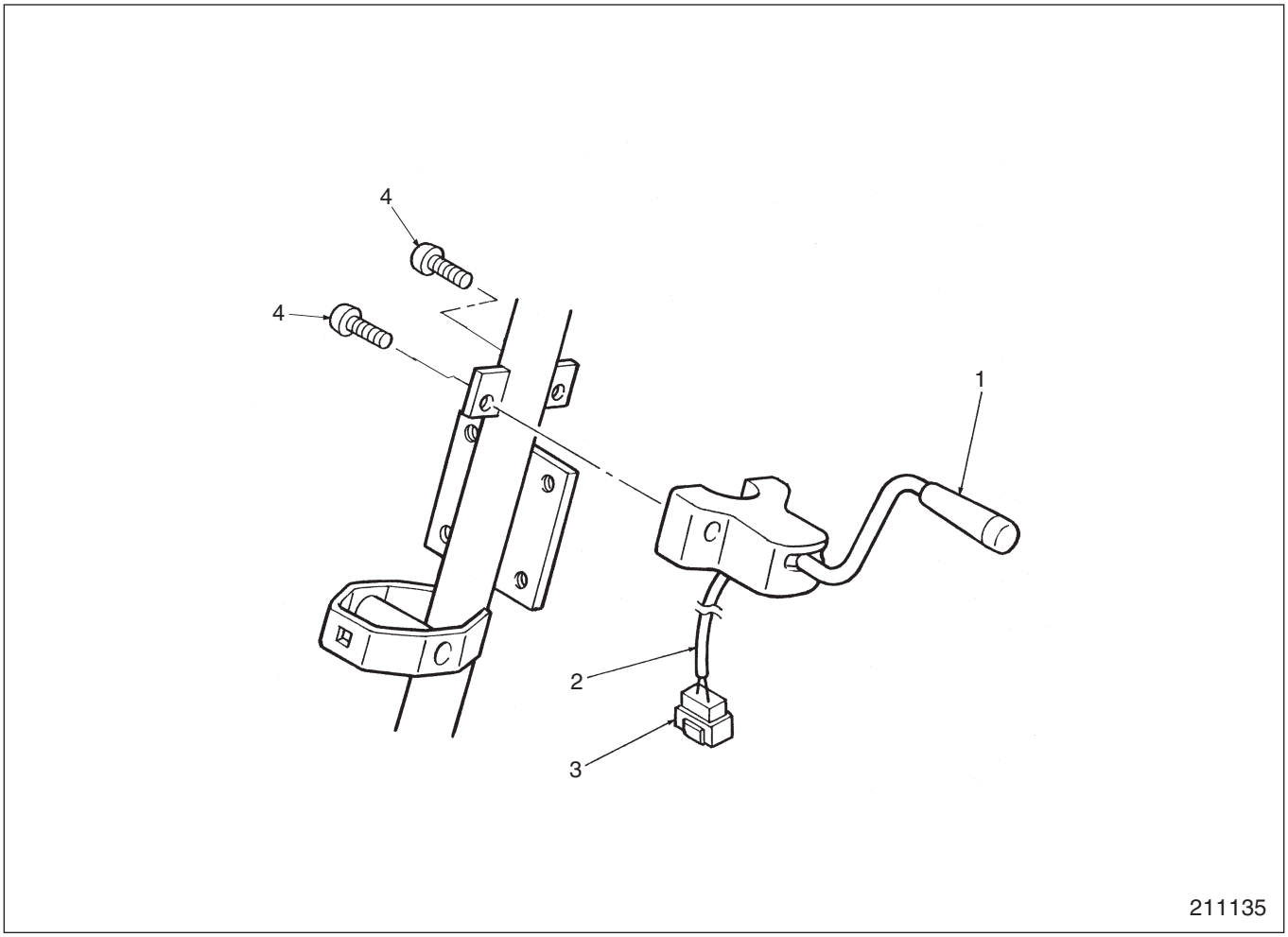
Reassembly

Follow the disassembly procedure in reverse.

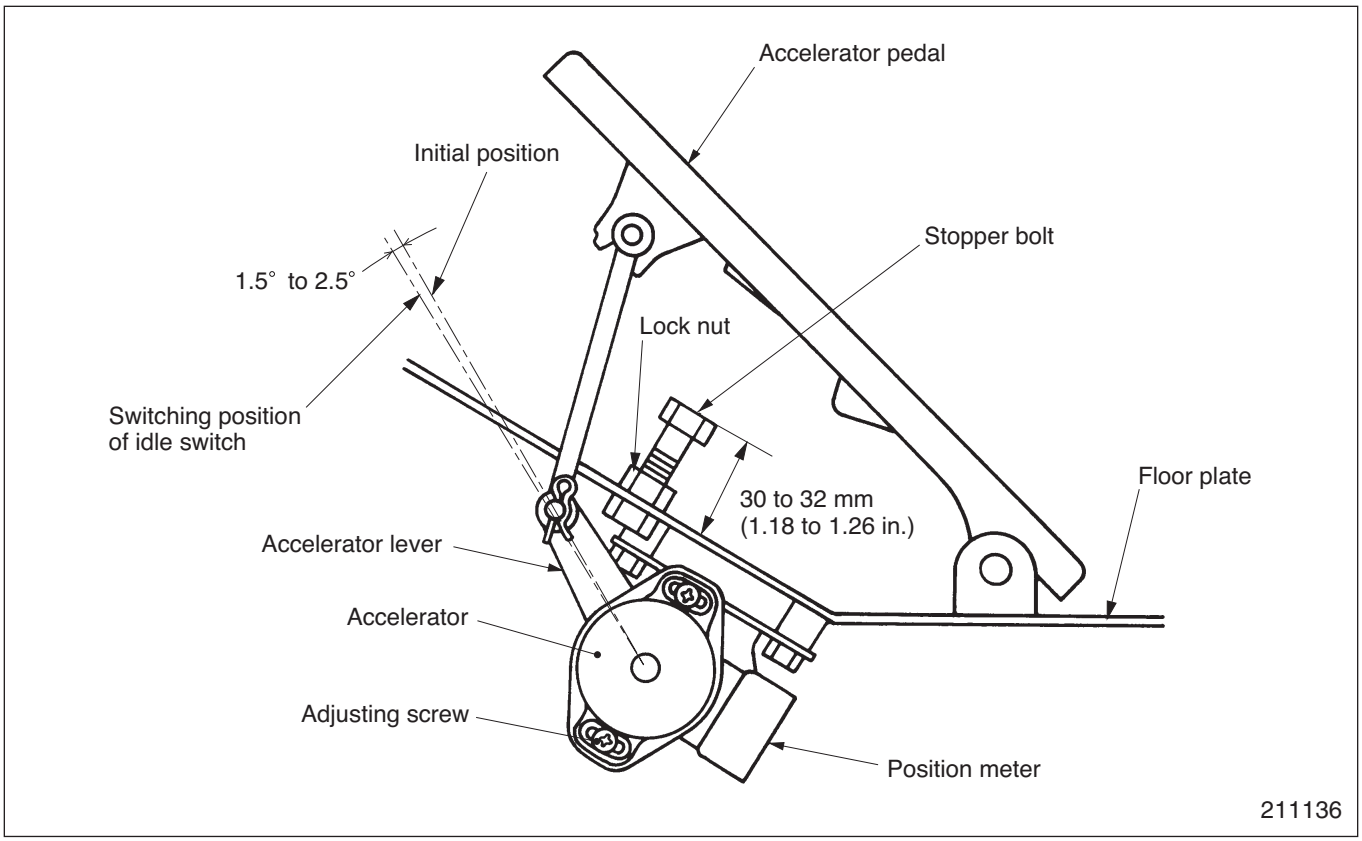
Direction Lever

Structure



1 Lever
2 Harness
3 Connector
4 Screw

Accelerator Control



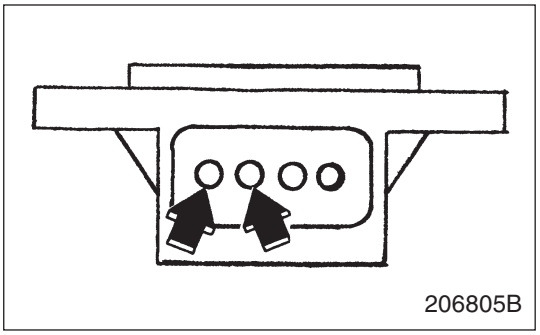
Adjustment procedure

(1) Disconnect the battery plug.

(2) Set the stopper bolt to 30 to 32 mm (1.18 to 1.26 in.) from the floor to the upper face of bolt.

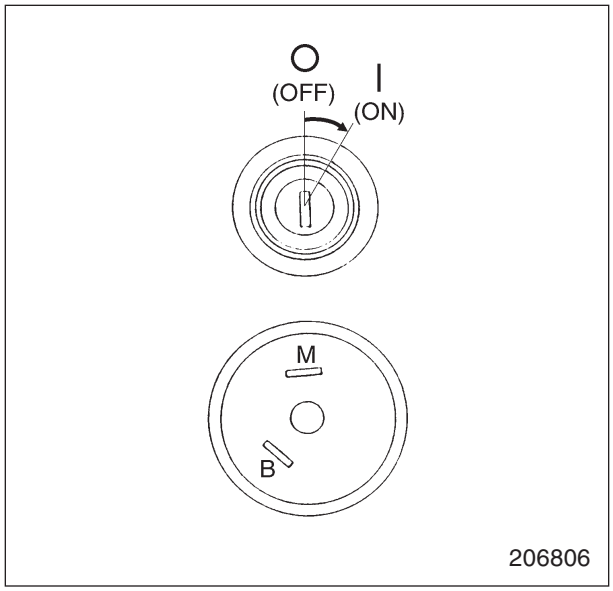
(3) Adjust the mounting angle of the position meter using the adjusting screw so the switch inside the position meter turns on when the accelerator lever is moved 1.5° to 2.5° from the initial position.

Make sure the inside switch turns ON by checking the continuity between the two terminals (indicated by arrows) using an ohmmeter.



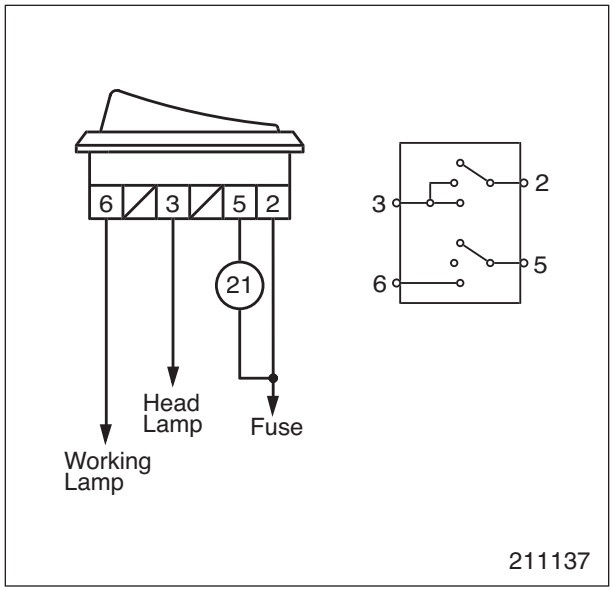
Key Switch

Terminal	B	M
Connection destination	Main fuse Battery	Logic card
○ (OFF)	○	
I (ON)	○	○



Lighting Switch

Terminal	2	5	3	6
Connection destination	Battery	Battery	Head lamps	Working lamp
OFF	○	○		
ON (1)	○	○	○	
ON (2)	○	○	○	○



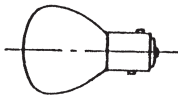
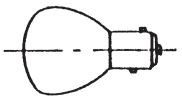
Fuses

Capacity (A)	Location	Main connecting device
500	Main controller	Main fuse
325		Pump motor
50		Steering motor
15	Fuse holder	Key switch, Lighting switch
10		Power relay

NOTE

Refer to Parts Manual for proper replacement fuses.

Lamp Specification Chart

Item / Lamp	Quantity	Bulb color	Bulb		Remarks
			48 V	External diagram	
Head lamps	2	Clear	45 W		
Working lamp	1	Clear	45 W		

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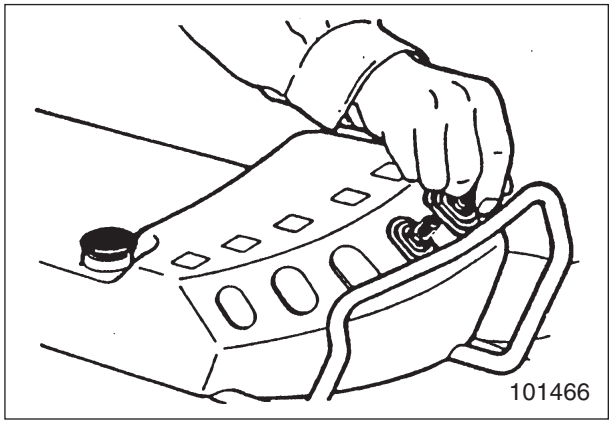
Troubleshooting of Lighting and Horn Systems

Complaint		Possible cause	Remedy
Lamps-general	Will not light	a) Dead or weak battery b) Fuses blown out c) Open or short in circuit d) Poor grounding e) Bulbs burnt out	Recharge or replace. Check and replace. Repair or replace. Clean ground spot and re-make connection. Replace.
	Will light dimly	a) Dead or weak battery b) Burned contact points in switches c) Loose terminals d) Dirty lenses e) Waterdrops inside lenses f) Bulbs expired service life	Check and recharge. Repair or replace. Retighten. Clean. Dry and replace packings. Replace.
Head lamps	Will not light	a) Lighting switch defective b) Bulbs burnt out	Replace. Replace.
Other lamps	Working lamp will not light	a) Working lamp switch defective b) Bulbs burnt out	Correct if improperly installed: replace if internally defective. Replace.
Horn	Will not give blast of sound	a) Fuse blown out b) Open or short in circuit c) Horn switch defective d) Horn defective e) Horn button defective	Check and replace. Repair or replace. Replace. Replace. Repair or replace.
	Will give an offensive blast of of sound	a) Horn switch defective b) Horn defective	Replace. Replace.

Joystick Box



Description

This system, unlike the conventional mechanical control, is electronically actuated to reduce the effort required of the operator in moving the control levers for lift, tilt and attachment functions.

(1) In the duplex and triplex full free masts, more oil returns from the 1st lift cylinder than from the 2nd lift cylinders to allow the 1st lift cylinder to retract faster for better maneuverability.

(2) This system provides the following safety functions:

(a) When the pump motor is not running, the lift, tilt and attachment functions will not work even if the control levers are moved.

(b) When the emergency switch is in the ON (pushed) position, the lift, tilt and attachments functions will not work even if the control levers are moved.

(c) When the seat switch is not ON (the operator is not seated), the lift, tilt and attachments functions will not work even if the control levers are moved.

(d) The fault detection indicator ! in the LED alerts the operator to malfunctions involving the electrical system and also an inoperable status. (If any problem occurs in the lift system, for example, the system becomes inoperative.)